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Director's Letter

Dear Member:

"Why the Heck Should I Give to Cycle Research?"

Why should you support cycle research?

I'll tell you, but first I want to tell you a little story:

A woman was visiting an insane asylum.

"How do you know when to let a patient out?" she asked.

The guide answered, "I'll tell you lady. We've got a big bathtub with no outlet. We turn on the water and we gives the nuts buckets and we tells 'em to bail her dry. Them as ain't nuts turns the water off at the spout."

Now this story has a point in connection with cycle study:

Two of the great scourges of mankind are wars and depressions. You may think wars are a thing of the past, but they are not. Depressions are not over either. And, if we succeed in "buying" our way out of the next one, as at the present we seem destined to try to do, the resulting inflation will be worse than the disease.

Both wars and depressions are cyclic. That is, they act as if they came and went in tune with rhythmic cyclic forces. Until we know more about what these forces are and how they operate we won't know all we need to know in order to control these wars and depressions. We'll be like the poor lunatics who bail and bail, trying to empty the tub, and never succeeding.

"Them as ain't nuts turns the water off at the spout." Are you a nut? If so, keep on enjoying yourself. But if you are *not* a nut, lend a hand toward abolishing ignorance and its consequent misery!

In this connection, a letter that came in yesterday is in point. It reads in part as follows:

"Looking in retrospect at your financial 'support' one is forced to the conclusion that you have collected a small army, some with honest curiosity and appreciation of the significance of cycles in the universe, but that mostly you have acquired a mass of leeches that regard you as Mr. Crystal Ball who, for ten bucks a year, is going to make 'em rich. Perhaps it is not too difficult to decide who is in which group by who has been willing to cough up a little extra. For example, what more could you have done if each of 9,000 members had volunteered 10% additional on his membership? This extra dollar would have cost him four packs of cigarettes or 1 1/2 martinis amortized over one year. A real hardship? The point to this diatribe is that it is probably more useful to cultivate the few than the many, just as you seem about to do."

There is much truth in what the author of this letter says, but he may be forgetting the thousand or more of our members who *do* contribute a dollar or ten dollars (fifteen martinis), or even a hundred dollars (wow!). It is they who keep the ship afloat and help it to go forward! To them our undying thanks, and the thanks of unborn generations.

Curiosity

My life seems to be more or less dedicated to trying to find out a little something about these rhythmic cycles that are of such great importance to mankind. This being true, you might think of me as quite a humanitarian—but you would be wrong! I hope *you* are a humanitarian, but *I* do not profess to be. My impelling force is *curiosity,* and the desire to do something in the world that is more important than making money.

Did you ever look up at the stars at night and let your mind dwell on the vast distances and the enormous numbers involved? If the earth were a ball the size of a plum, the nearest star would be as far away as New York is from San Francisco. Our sun would be as big as a load of hay, and would be a quarter of a mile away. If our sun were as small as a grain of rice, a handful of rice spread out at random on a deep blue rug would represent the visible stars—but it would take *40 railroad boxcar loads* of rice to represent all the stars which are disclosed by our mighty telescopes!

When one thinks of these things and the other marvels of nature, and when one has supplied oneself with food and clothing and the other things that one needs for reasonable comfort, it seems trivial to go on adding more and more to one's little pile. Rather it would seem more worth while to try to get a better knowledge of the universe in which we live. Any little animal like a woodchuck or a chipmunk or a spider or a flea can earn a living and maybe a little more. But that's all *they* can do. Man, to the contrary, can unravel the secrets of the Universe. If he doesn't try to, but contents himself with the mere accumulation of pelf, and with status seeking, he is little better than the animal from which he sprung. He is squandering his birthright.

Of course I realize that we can't all be seekers. Some of us don't have the aptitude or the training. Some of us are in a cocoon of commitments and obligations from which we cannot disentangle ourselves. But what each non-seeker *can* do is to lend some of his strength to someone who is seeking, and thereby have a part, even though at second hand, in man's greatest adventure.

Of course these are just one man's ideas. Other people have different points of view. For example, I once asked Hellen Keller if she could put into a phrase the meaning of the Universe. She said it was "the expression of God's infinite love." Now I see love all around us: in my fellow human beings, even in the animals. It is one of the attributes of life. It is perhaps the most wonderful thing in the world but to my mind it does not epitomize the Universe. Through my eyes the phrase "fulfillment of the law" would come much closer. And to learn what that law is so that one can conform to it is one of the supreme commands. Let us then obey it, you and I, each in his own way.

Cordially yours,

Edward R. Dewey

Director

Research by Staff

CYCLES, THE SCIENCE

PART III: THE MOON AS A CAUSE OF CYCLES

By Edward R. Dewey

All of us on earth "find ourselves aboard a ship on the high seas of space," as Dr. Harlan True Stetson, my old astronomy professor, puts it. We should know the tides, the channels, and the shoals if we are to navigate intelligently.

In Part I of this series we attempted to explain our hypothesis that "something out there" causes the tides (*i.e.* the cycles) in the affairs on earth. "Something out there," let me hasten to add, could be *inside* as well as *outside* the earth. Whatever it is seems merely to be "out there" relative to *us*.

In Part II, I listed some of the possible causes of the cycles. These include the sun, the moon, the planets, energy waves from outer space, etc. Now we want to consider each possible cause separately.

I will start with the moon. Everyone knows that the moon is one of the main causes of the tides of the sea, but is not generally realized that there are many cyclic events on earth which are caused partly or wholly by the moon, or which at least occur simultaneously with the lunar cycles.

Before we get too deeply involved in detail and in cataloging let me give you an example taken from that fascinating best seller, *The Sea Around Us*,* by Rachel L. Carson. (If you don't own this book I suggest you buy it. I am quoting rather extensively from it so you can see the style and the clarity with which Miss Carson writes.):

"The influence of the tide over the affairs of sea creatures as well as men may be seen all over the world. The billions upon billions of sessile animals, like oysters, mussels, and barnacles, owe their very existence to the sweep of the tides, which brings them the food which they are unable to go in search of. By marvelous adaptations of form and structure, the inhabitants of the world between the tide lines are enabled to live in a zone where the danger of being dried up is matched against the danger of being washed away, where for every enemy that comes by sea there is another that comes by land, and where the most delicate of living tissues must somehow withstand the assault of storm waves that have the power to shift tons of rock or to crack the hardest granite.

"The most curious and incredibly delicate adaptations, however, are the ones by which the breeding rhythm of certain marine animals is timed to coincide with the phases of the moon and the stages of the tide. In Europe it has been well established that the spawning activities of oysters reach their peak on the spring tides, which are about two days after the full or the new moon. In the waters of northern Africa there is a sea urchin that, on the nights when the moon is full and apparently only then, releases its reproductive cells into the sea. And in tropical waters in many parts of the world there are small marine worms whose spawning behavior is so precisely adjusted to the tidal calendar that, merely from observing them, one could tell the month, the day, and often the time of day as well. . .

"Concerning each of these, the question recurs but remains unanswered: is it the state of the tides that in some unknown way supplies the impulse from which springs this behavior, or is it, even more mysteriously, some other influence of the moon? It is easier to imagine that it is the press and the rhythmic movement of the water that in some way brings about this response. But why is it only certain tides of the year, and why for some species is it the fullest tides of the month and for others the least movements of the waters that are related to the perpetuation of the race? At present, no one can answer.

"No other creature displays so exquisite an adaptation to the tidal rhythm as the grunion—a small, shimmering fish about as long as a man's hand. Through no one can say what processes of adaptation, extending over no one knows how many millennia, the grunion has come to know not only the daily rhythm of the tides, but the monthly cycle by which certain tides sweep higher on the beaches than others. It has so adapted its spawning habits to the tidal cycle that the very existence of the race depends on the precision of this adjustment.

"Shortly after the full moon of the months from March to August, the grunion appear in the surf on the beaches of California. The tide reaches flood stage, slackens, hesitates, and begins to ebb. Now on these waves of the ebbing tide the fish begin to come in. Their bodies shimmer in the light of the moon as they are borne up the beach on the crest of a wave, they lie glittering on the wet sand for a perceptible moment of time, then fling themselves into the wash of the next wave and are carried back to sea. For about an hour after the turn of the tide this continues, thousands upon thousands of grunion coming up onto the beach, leaving the water, returning to it. This is the spawning act of the species.

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* Copyright 1950, 1951 by Rachel L. Carson. Published by the Oxford University Press. Price $4.00. A paperback edition of the book is also available from the New American Library.

"During the brief interval between successive waves, the male and female have come together in the wet sand, the one to shed her eggs, the other to fertilize them. When the parent fish return to the water, they have left behind a mass of eggs buried in the sand. Succeeding waves on that night do not wash out the eggs because the tide is already ebbing. The waves of the next high tide will not reach them, because for a time after the full of the moon each tide will halt its advance a little lower on the beach than the preceding one. The eggs, then, will be undisturbed for at least a fortnight. In the warm, damp, incubating sand they undergo their development. Within two weeks the magic change from fertilized egg to larval fishlet is completed, the perfectly formed little grunion still confined within the membranes of the egg, still buried in the sand, waiting for release. With the tides of the new moon it comes. Their waves wash over the places where the little masses of the grunion eggs were buried, the swirl and rush of the surf stirring the sand deeply. As the sand is washed away, and the eggs feel the touch of the cool sea water, the membranes rupture, the fishlets hatch, and the waves that released them bear them away to the sea."

With this preview of some of the interesting lunar-terrestrial interrelationships that we shall consider, let us pause now, for background, to review some of the cycles to be found in the behavior of the moon itself.

CYCLES OF THE MOON

There are four main kinds of lunar cycles. Two of them—the monthly and the daily cycles—are known to everyone. The other two may not be familiar, as they require more careful observation.

The Lunar Month

The *monthly* lunar cycle is caused by the revolution of the moon around the earth. As you know, the moon revolves around the earth once a month just as the earth revolves around the sun once a year. Both revolutions are in the same directions—counter clockwise when looked at from above (north). This cycle causes the monthly reappearances of the phases of the moon—new moon, first quarter, full moon, third quarter, and new moon again. This cycle has many earthly effects—as we shall see.

The length of this monthly cycle, relative to the sun—that is, from full moon to full moon—is 29.53059 days. This length is known as the *synodic* month from the Greek word *synodos,* a meeting.

There are four other ways of measuring the lunar month, as follows:

If you measure the time it takes the moon to go around the earth and come back to the same place in its orbit relative to the fixed stars you get what is called the *sidereal* month. Sidereal comes from a Latin word meaning star. The month measured this way is, on the average, 27.32166 days long.

The time required for the moon to go around the earth and come back to the same place relative to equinox is, on the average, 27.32156 days. This period is called the *tropical* month.

The path of the moon around the earth is an ellipse. There is of course one point on this ellipse that is closest to the earth. If you time the revolutions of the moon from one closest point to the next closest point you get another length. This one, on the average, is 27.55455 days long. This period is called the anomalistic month from a Greek word meaning irregular.

And finally, if you time the circuit of the moon from a time when it cuts down through the plane of the earth's orbit until the next such time you get what is called the *nodal* or *draconic* month. It averages 27.21222 days long.

I mention all these various months, as well as the calendar month of 30.44 days, in part for the record and in part to show you how very important accurate measurments are if we want to pin down the cause of cycles.

The Lunar Day

The daily cycle of the moon—moon rise to moon rise—is caused of course by the monthly revolutions of the moon around the earth in combination with the 24-hour rotation of the earth around its own axis. As the moon goes around the earth in the same direction in which the earth revolves, the daily cycle of the moon is a little larger than the solar day—it takes any given point on the earth a little longer to catch up. The daily cycle of the moon is 24 hours, 50 1/2 minutes long, on the average.

This cycle causes tides in the ocean, in the atmosphere, and in the solid earth itself. It has a number of other terrestrial effects, too, as we shall see.

The Cycles of the Moon's Orbit

I have mentioned that the moon goes around the earth in an orbit which is an ellipse. An ellipse is a sort of flattened circle. The earth is near one end of this ellipse.

This means that, as we see it, the moon appears to be slightly bigger at one part of the lunar month than at another.

If you looked down on the earth-moon system and traced the moon's orbit you would see that the end of the orbit nearest the earth pointed in a particular direction—that is, toward some particular star. If you watched carefully you would see that the orbit would wobble back and forth so that the time from one point closest to the earth to the next point closest to the earth is slightly irregular. This irregularity repeats in a cycle which on its part is 31 years and 2 or 3 days long (depending on how leap years fall). This fact was just recently discovered by one of our members, Hector H. Wolfe. He reports his findings in an article to be published in a forthcoming *Journal of Cycle Research*.

Again, looking down on the earth-moon system over a period of months you find that the axis of the orbit not only wobbles, but turns slowly in a counter-clockwise direction making one complete revolution relative to the stars in 8.85 years (3,232.6 days to be exact).

Except for gravity, no terrestrial effects of the cycles of the moon's orbit have yet been proved, as far as I know.

The Cycle of the Moon's Plane

The orbit of the moon does not lie exactly in the same plane as the orbit of the earth. That is, if the earth-moon system were looked at sideways, for half the lunar month the moon would be a little above the line connecting earth and sun, for the other half a little below it.

One effect of this fact is that sometimes the moon is higher or lower in the sky than it otherwise would be.

The line where these two planes—the plane of the earth's orbit and the plane of the moon's orbit—intersect is called the line of nodes. This intersection line also rotates (clockwise) over the years so that in 18.6 years (6,793.5 days) it is back, relative to the stars, where it started.

As far as I know, this 18.6-year lunar cycle has never been proved to have any terrestrial effect either. And nothing is known—at least to me—to suggest how it could possibly have any effect. Nevertheless it may not be amiss to point out that the well known 9.3-year cycle is seemingly just one half this 18.6-year length. This is probably mere coincidence, but still it is curious.

Now that we have noted the four chief sorts of lunar cycles, let us turn to a consideration of earth-moon interrelationships.

LUNAR-TERRESTRIAL INTERRELATIONSHIPS

The above review of the cycles of the moon itself is a necessary preliminary to a review of the interrelationships between the moon and the earth. These interrelationships may be of several kinds: physical, biological, social, economic. Of the possible physical interrelationships between the earth and the moon the best known and certainly the best defined are the tides in the sea.

Tides in the Sea

Tides in the sea are set into motion by the gravitational forces of the sun and moon. Each of these has a varying effect according to the location, and according to the phase of the moon. In most places both the sun and the moon affect the tide, but at some places, such as the island of Tahiti, high tide comes at noon and midnight according to the sun, and there is very little response to the moon.

Note that the cosmic forces largely set the *timing* of the tide. The *character* of the tide in any given spot is a matter of the geography of that particular spot.

This problem has been studied since the first boat was built. The answer is now complete enough so that accurate long range predictions are prepared. Something of the nature of tides, the effect of the moon and sun, and the manner in which the forecasts are made is covered in the following excerpt from "The Prediction of Tides" by Captain Paul C. Whitney.*

"It is well known that the tides in any place vary in range day by day and advance in time of occurrence each day, and in different places vary greatly in character during the month. The different characters of the tide fall into three groups: the daily or one high and one low water each day, the semidaily or two high and two low waters a day, and the mixed. The latter type may vary in character during the month, being semidaily most of the month and daily for some days. The daily tide is found along some parts of the Gulf of Mexico shores and the China coast. The semidaily tide is the most prevalent over the world. It is exemplified at New York as will be noted in the annual tide table. The mixed tide is found, among other places, along the Pacific coast of the United States. Figure 1 illustrates the three principal types of tide. The upper diagram shows the semidaily tide at New York, where the tide rises and falls twice each day with the morning and afternoon tides nearly of the same height. The daily tide at Pensacola is shown in the middle diagram. The mixed type occurring at San Francisco, given in the lower diagram, illustrates the large difference in range between the morning and evening tides. It should be noted that the illustration is for the same seven days and brings out the different tidal responses to the same tide-producing forces of the moon and sun.

"By the use of harmonic constants, which are derived from the harmonic analysis, it can be shown why these different types exist. The analysis shows that they are all caused by the combining effects of constituents of different amplitudes and epochs that are contained in the tidal curve. This may be understood by an examination of Fig. 2. Here are plotted for the week beginning August 23, 1936, four of the principal constit-

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* Published in United States Naval Institute Proceedings, Vol. 66, No. 12, Whole No. 545, December 1940. Reprinted by the Foundation for the Study of Cycles as Reprint No. 5.

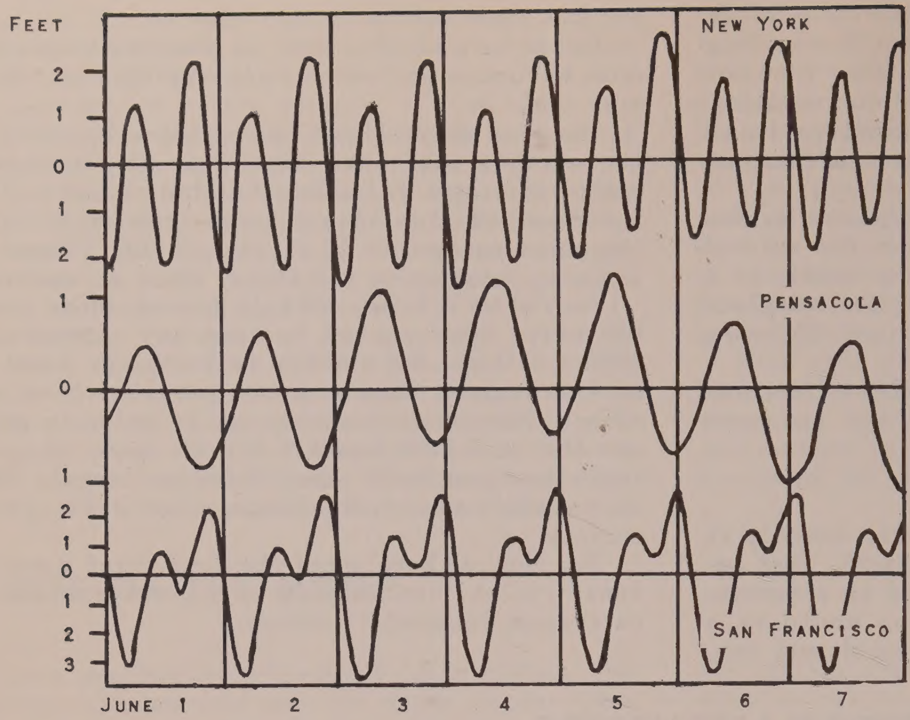


Fig. I TYPES OF TIDES

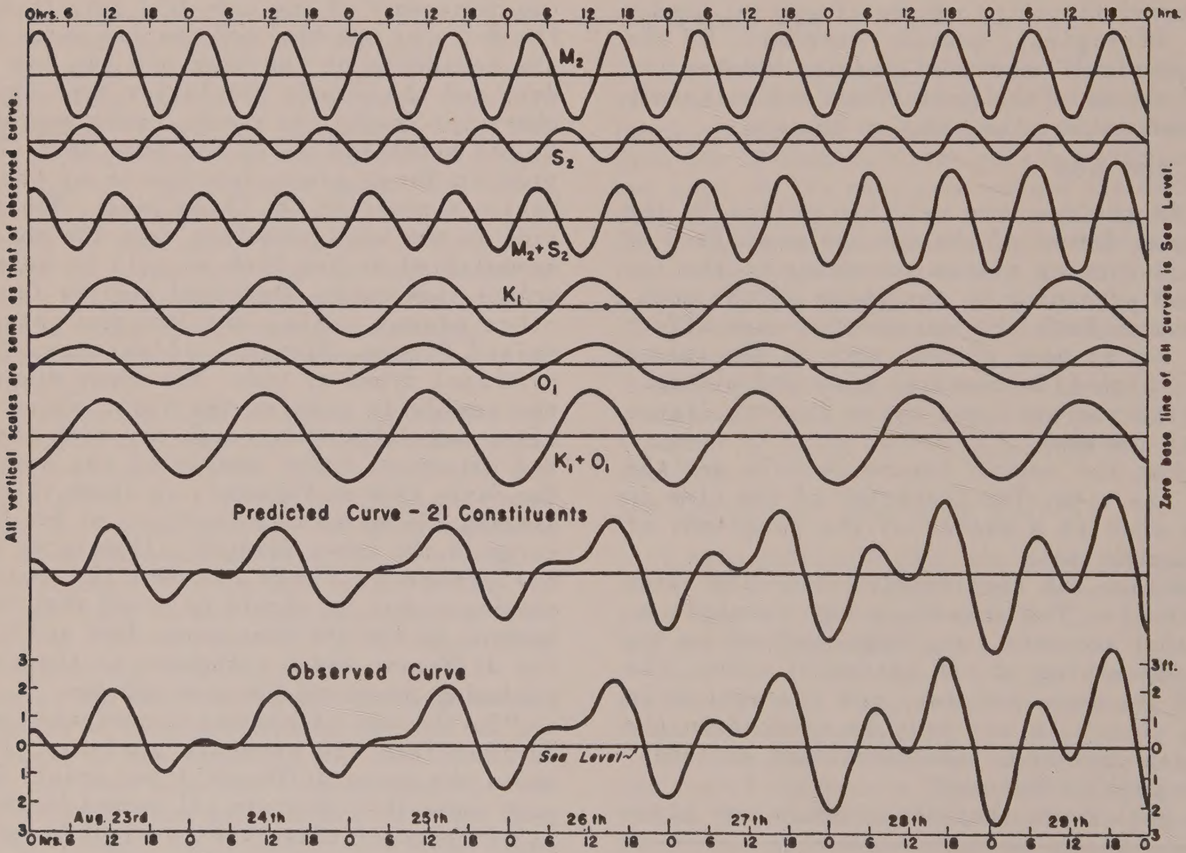
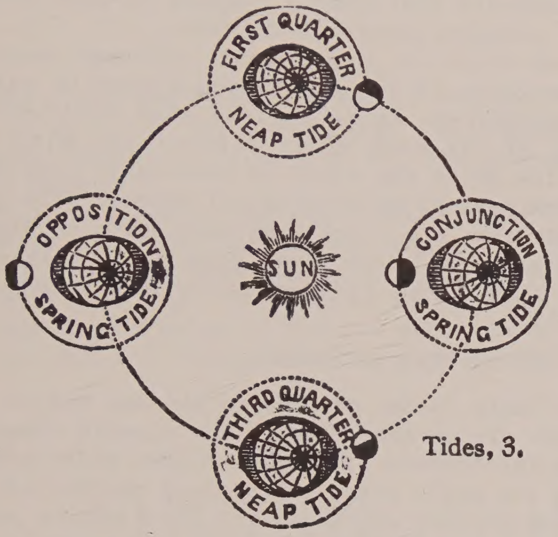


Fig. 2 CONSTITUENT AND PREDICTED TIDES

Los Angeles, California Aug. 23-30, 1936 uents of the tide at Los Angeles, California. The upper two are the M_2 and the S_2 constituents. These are the principal lunar and solar semidaily constituents and the combining effects of the two are shown in the M_2+S_2 curve. The effect of the moon's phases is clearly shown. On the 25th when the M_2 and S_2 curves were completely out of phase, the moon being in first quarter, the resulting amplitude or range was small. As the moon approached full and the curves began to come into phase, the amplitude of the combined curve increased. This waxing and waning continues throughout each lunar month, giving the familiar spring and neap tides.

[When sun and moon are in conjunction or opposition, as at new moon and full, their combined action produces a tide greater than usual, called *spring tide*. When the moon is at first or third quarter, the high tide (*neap tide*) is smaller than usual. The rising of the water is called *flood tide*; the reflux, *ebb tide*.]



Tides, 3.

"At Los Angeles is found the mixed type of tide, which means there must be comparatively large daily constituents in the tide. In the figure there are shown the two principal lunar and solar daily constituents, K_1 and O_1 and below the sum of the two, the K_1+O_1 curve. Combining the semidaily M_2+S_2 curve with the daily K_1+O_1 curve and 17 other minor constituents not shown, there is obtained a curve which represents the predicted curve for the period.

"The predictions shown in the illustration for Los Angeles were made in 1934. Two years later the actual tide was recorded on the gauge at the Los Angeles primary tide station. This observed record is shown plotted below the predicted curve. An interesting point in the period selected is that on August 25 and 26 the tide became daily in the predictions, as well as in fact, a very nice demonstration of how accurately the amplitudes and epochs of the several constituents are known.

"At a place where the daily tide predominates, as for example, Pensacola, Florida, examination will show that the K_1 and O_1 constituents make up practically the entire tide, the semidaily constituents being small. At Portland, Maine, where the tide is almost purely a semidaily one, we find that the M_2 and S_2 constituents predominate. Figure 2 also illustrates the character of the Los Angeles tide in that there is an inequality in the high waters and low waters. Farther north at Port Townsend the constituents so combine at different times of the month that there is a small inequality in the high waters and a large inequality in the low waters. At such times there is almost a high water stand for several hours followed by a quick run out to a lower low water."

The tides that make the *Queen Mary* wait for slack water to dock also rule the lives of creatures whose home is the ocean; books by such naturalists as Rachael Carson abound with illustrations.

The review of tidal analysis in the above article by Captain Whitney gives some insight into the problem of cycle analysis. There are two main generating forces which time the cycle (daily or semidaily, high or low, spring or neap), but the character of the tide at a particular place is determined by the geography of the place. For example, the tides on the east end of the Panama Canal run about a foot, while 40 miles away on the Pacific side the tides run 12 to 16 feet.

Other Physical Manifestations of the Earth-Moon System

The completeness of the analysis of the tides also points up the incompleteness of the work that has been done in studying other physical lunar-terrestrial interrelationships. It is not possible to present a summary, so far as I know, of any one of these interrelationships, which would have the thoroughness of the sea-tide analysis.

Yet it is known that there are tides in the atmosphere that are influenced by the force of the moon.

There are changes in geomagnetism that are attributed to the moon. Harlan Stetson states that it is well known that changes in geomagnetism follow the changing phases of the moon. Stetson also has found that changes in radio field strength follow the changing phase of the moon (probably because of a secondary effect of the moon on the ionosphere).*

It has been postulated that movements in the earth's crust are related to the position of the moon.

F. Schultz, writing in *Bio-Dynamics* (Winter, 1941 issue) says, "Arrhenius was the first to discover the notable effect of the moon on the northern lights and the formation of thunderstorms. Here the maximum takes place when the moon passes through its lowest point in the zodiac. Arrhenius and also, later, Schuster, established that a considerably greater number of thunderstorms occur during the waxing phase of the moon than during the waning phase."

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* SUNSPOTS IN ACTION. THE RONALD PRESS COMPANY. NEW YORK. 1947.

Researchers generally are more concerned with the relationship between sunspots and auroras or other weather disturbances. Attempts should be made to combine the two (i.e. sun effect and moon effect), and to add the local conditions (in terms of meteorology) to make an air tide, or auroras, or weather disturbance curve similar to the tidal curve:

There are many bits of information here and there, but the entire problem needs to be tied together; if there are several sources of varying effect operating simultaneously these must be measured as to changing effect; if local conditions cause a variation in receptiveness to cosmic forces, this factor must be taken into account.

All of this should be done with data covering continuous and long periods of time over a wide geographical distribution.

Effect of the Moon on Plants

The effect of the moon on the physical environment—an effect which would continue whether plant and animal life were present on earth or not—is being continuously studied, although complete and definite answers are still to come. On the other hand, many of the possible effects of the moon on plant life belong in the realm of folklore. Even so, serious scientific work is being done on this phase of lunar-terrestrial relationships.

For instance, the Department of Agriculture has investigated the problem of whether planting crops during certain phases of the moon will affect the ensuing growth and yield of the crop. They found that the phase of the moon in which a crop is planted has no relation to its outcome. The idea that there is such an interrelationship continues to be considered folklore by the Department of Agriculture.

Folklore may or may not be based on fact, however. It is said that timber in the tropics must be felled at the correct phase of the moon. If the trees are cut when the moon is waxing, the sap runs heavy and draws beetles which eat the wood. In fact, we read that contracts to cut timber in South America and the South Sea Islands sometimes specify that the wood is to be cut only during the waning phase of the moon.

This phenomenon is not surprising when you consider the work of H. S. Burr with the electric potential of trees.* Burr drilled tiny holes several feet apart (vertically) on a tree trunk and connected the holes with wire. An electric current flows along such a wire, and Burr has recorded minute by minute the flow of current in trees for many years. The current sometimes flows up and sometimes down. The flow of the current is not steady; the voltage varies. Furthermore, *the same strength of current flows in the same direction at the same time in trees which are miles apart!*

The variation in voltage goes in cycles, and one of the cycles observed appears to correlate with the phases of the moon. Of course any effect of the moon may be direct, or it may be secondary.

Dr. Frank A. Brown, Jr. and his associates have found that pieces of potato, hermetically sealed in rigid containers under constant conditions of pressure and temperature showed (among other things) a lunar monthly rhythm of metabolism (oxygen consumption).** The rate was lowest at the time of the new moon, and went up to a high during the third quarter of the moon during the full year the potatoes were studied.

Thus, solid evidence is being collected which does indicate that plants respond to some extent to the changing phases of the moon.

Lunar cycles in plants exist, although research on this phase of the earth-moon system is really just beginning. It is logical that work on the effect of the moon would start first with the tides (on which the story is remarkably complete) and then move to other physical aspects (the air, geomagnetism, etc.) and then move again to plants and animals—and lastly man (man doesn't like to admit that he is influenced by environmental forces!)

Effect of the Moon on Animals

The lunar cycles of life in the sea and on the seashore are obvious. One of the classic examples is the Palolo-Worm of the South Seas which swarms during the night prior to the last quarter of the moon in October or November. This can be seen; what I want to talk about here is a lunar cycle which is not so obvious. In fact, the manner in which this particular lunar cycle seems to work may prove to be a most important cycle discovery.

This discovery was made by Lauri Siivonen and Jukka Koskimies and is reported in *Papers on Game Research* (No. 14, 1955) published by the Finnish Game Foundation.

Their hypothesis concerns the manner in which the biological cycle of an animal and the cycle of the moon's phase may combine to create a third cycle. It is the third cycle which one sees.

In summary, the hypothesis ties together two known facts: first, there may be a fixed *critical* period in early spring when reproductive activity of birds and animals is at a maximum because of the basic seasonal physiological pattern and second, there is a cycle in the variation of the timing of the new moon.

The length of the cycle of the new moon (al-

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* "DIURNAL POTENTIALS IN THE MAPLE TREE." YALE JOURNAL OF BIOLOGY AND MEDICINE. VOL. 17. NO. 6. JULY 1945.

** "THE RHYTHMIC NATURE OF ANIMALS AND PLANTS" NORTHWESTERN UNIVERSITY TRI-QUARTERLY. VOL. 1. NO. 1. FALL 1958.

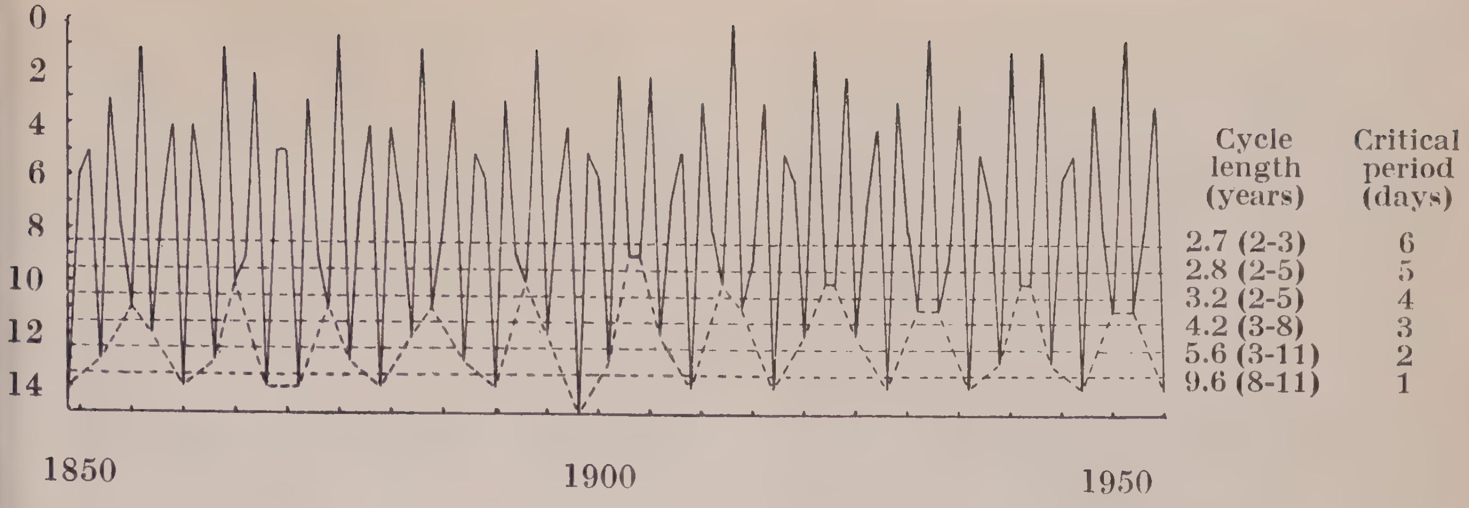

Fig. 1. The cycle lengths of the lunar fluctuations in 1849-1955 with April 6th as the critical date. The dotted curve connecting the lunar minima illustrates the 9.6-year cycle.

lowing ± one day from an assumed "critical" period at April 6) is 9.6 years. (The wider the critical period is allowed to be, the shorter the cycle becomes.)

This is shown on the chart above which is reproduced from the Finnish Game Foundation paper. On the chart the dashed line connects the time of the new moon (or the periods of minimum night activity). The dates of the new moon coming closest to April 6 (the assumed critical date) are plotted as days before or after April 6. The dashed line connects the lows.

The second chart compares the 9.6-year cycle in the new moon with the 9.6-year cycle found in the fluctuation of the population of the varying hare in Canada. The correspondence is obvious. The recorded fluctuation in the number of varying hare has for over 100 years tended to coincide with the timing of the lunar cycle.

Siivonen and Koskimies would be the last per-

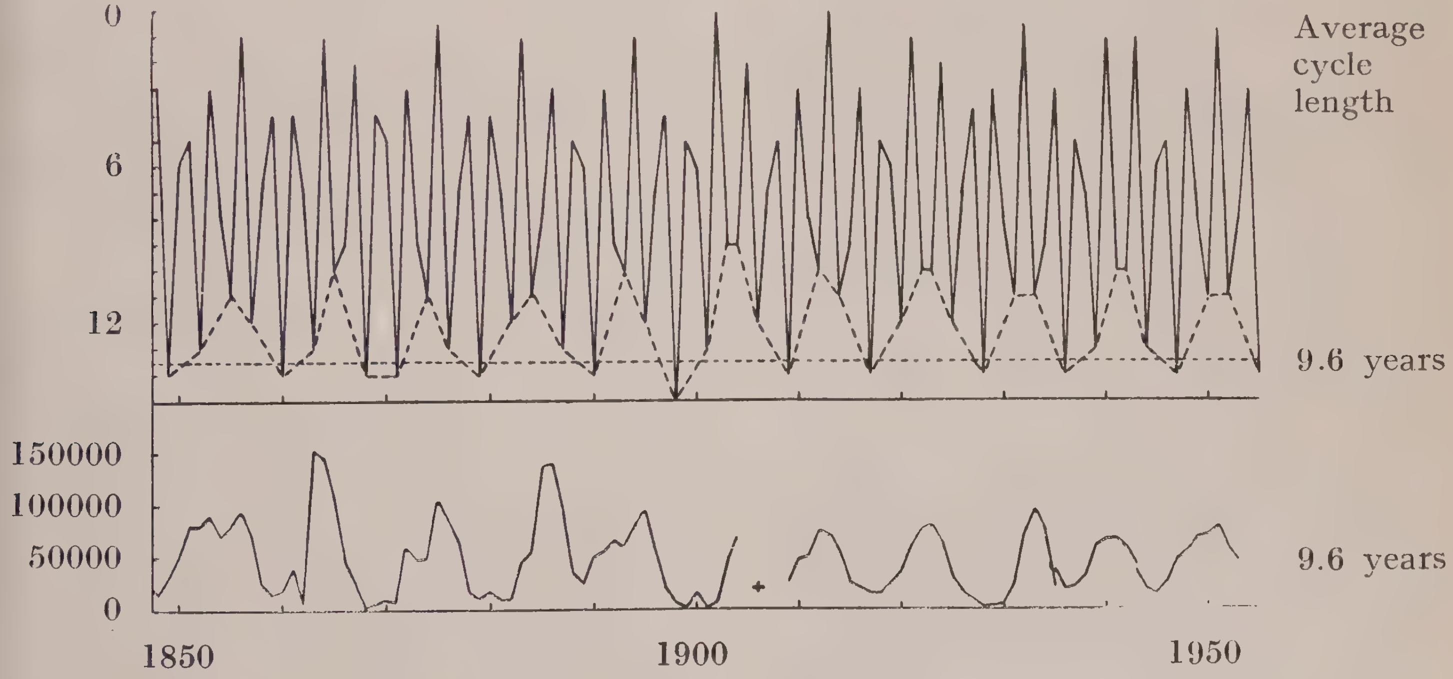

Fig. 2. The 9.6-year lunar fluctuation (dotted curve in upper diagram) in 1849-1955 with April 6th as the critical date, and the 10-year fluctuation of the varying hare in Canada (lower diagram) during the same period according to MacLulich (1937). Chitty (1933-1948) and Roman (1955). Moon values (ordinate), cf. Fig. 1.

sons, I am sure, to claim that their hypothesis has been *proved,* but it is most ingenious and lies along the lines in which I feel that much future progress in cycle study will be made.

The work of Siivonen and Koskimies is somewhat of a departure from the traditional explanation of biologists concerning springtime reproductive activity. For instance, A. S. Pearse in *Animal Ecology** while conceding the influence of the tides on sea and shore life, explains the spring reproduction cycle of animals on the basis of optimal temperature and feeding conditions. Although it is true that optimal environmental conditions exist in the spring, and this does explain the physiological readiness of animals for reproduction, nevertheless it does not explain the variation in the rate of reproduction from year to year. Siivonen and Koskimies take the problem one step further and in addition give a physical mechanism to explain the rhythm of the variation. This mechanism is the coincidence of the "critical" spring days and the full moon, a circumstance which occurs, on the average, every 9.6 years for the varying hare, and many other northern animals. This pertains only to the basic rhythm which will, of course, be disturbed to some extent by extreme climatic or biological conditions.

Aside from the well-known lunar cycles in sea life and such isolated discoveries as the possible reason for the 9.6-year cycle in animal population, not much is known about the effect of the moon on animals—especially homo sapiens.

Effect of the Moon on Man

The scientific study of man has, for the last 100 years or so, been concerned more directly with man himself, muscle and nerve and heart and brain, the physical structure. A few scientists concerned themselves with man in relation to his terrestrial and cosmic environment, but more effort has been spent (and rightly so) with finding out how germs make people sick, and how the response of the physical mechanism cures them.

More recently work has begun to accumulate on the ecology of mankind—the relation of man to his environment and his reaction to the constant changing of the environment.

Since the environment changes in rhythmic patterns, it follows that response to change will be rhythmic.

The background for this subject is buried deep in the consciousness of the race. The word lunacy, for instance, came into use as a direct response to a general belief in a connection between the moon and certain forms of insanity which were interrupted by lucid periods, the change from sane to insane occurring in phase with the moon.

Sleep walking is sometimes attributed to the influence of the full moon, and certainly the supposed romantic influence of the moon is the source of much income to song writers.

In addition to these and other traditional beliefs in the influence of the moon, there is much scientific evidence of a lunar influence on human activity.

In 1950 I published a summary of the number of births divided as to the waxing or waning period of the moon. The record covered 6 years, 1939 through 1944, and was supplied by Curtis Jackson, then Controller of the Methodist Hospital of Southern California. Of the babies born at that hospital during the time covered, 17% more were born during the waxing period of the moon than were born during the waning period of the moon.

The record, year by year, follows:

Year	Waxing Period	Waning Period	Difference, Waxing Over Waning	% Waxing Over Waning
1939	770	614	156	25.4
1940	769	687	82	11.9
1941	933	787	146	18.6
1942	1,283	1,156	127	11.0
1943	1,203	957	246	25.7
1944	999	849	150	17.7
	5,957	5,050	907	17.7

One of the most comprehensive reviews of the possible effect of the moon on man is contained in the book *Man Weather and Sun* by Dr. William F. Petersen.*

While pursuing lunar effects, Petersen stresses that they cannot be regarded with the assurance of solar effects; at the same time he noted that Galileo considered the suggestion that the moon might influence the tides as approaching the occult.

Petersen put data of various kinds of vital statistics on a lunar axis to see if there appeared to be any relation to the phase of the moon. These figures included an index of conceptions compared to deaths, the incidence of scarlet fever, the incidence of epileptic attacks, deaths from tuberculosis, and others.

It is important to point out that while in a number of cases there appears to be a relation between the event being examined and the phase of the moon, this is only one factor in the sum total of causative factors.

For example, there appears to be a definite lunar phase to the chart of deaths from tuberculosis, with an increase in deaths after the full moon. Nevertheless, this is only one factor. Certainly, *in any individual case,* local weather conditions, the condition of tuberculosis patients and other factors are much more important than the phase of the moon.

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* Published 1939 by McGraw-Hill Book Company. The chapter on "Rhythms" (VI) was reprinted by the Foundation as Reprint No. 30.

* Charles C. Thomas, Publisher, Springfield, Illinois, 1947.

Nevertheless when put on a lunar axis and smoothed by a 3-day moving average the record of deaths from tuberculosis does show a high 7 days after the full moon and a low 11 days before the full moon.

Petersen (who was a medical doctor) was concerned about mankind and spent his life studying man. He felt that, in addition to the great knowledge of bacteriology and immunology, it is necessary to relate man to his environment; however minor the cosmic and terrestrial influences might be in any given case, he believed they should be taken into account.

Petersen, I might say in passing, was one of the dozen or so truly great men I have known in my lifetime.

CONCLUSION

Evidence is constantly accumulating which tends to show that the moon exerts an influence on terrestrial affairs, in physical environment and in plants and animals, including man. The material presented above is really a brief summary—a partial outline for a book on the subject rather than a comprehensive survey.

The influence of the moon varies in cycles, as the moon varies in cycles.

We have referred to the earth-moon system in this discussion, but this really is cutting the whole sun-earth-moon system into parts. This division does not happen in nature, because whatever the effect of the moon, the sun is usually the dominant factor in our immediate environment; the moon usually functions only in relation to *both* the earth and the sun.

The next article in this series will be about the sun.

Letters to the Editor

CYCLES - PRO AND CON

Mr. Brady, I like the bulletin. It's enlightening. An associate, however, says it's slanted.

You've presented the material to prove that there are cycles. What about the cycles that fail after a number of years; or the possibility that if you present the material another way there won't be a cycle at all.

Are you fooling us? Or leaving something about these cycles unsaid? Let's hear about a few flops.

Good naturedly,

Minneapolis, Minnesota J. J. Ahern, Jr.

Comment: I enjoyed your letter. It depends what you mean by "slanted."

There is a drug known as "606" because it took its developer 605 tries before he got something that would work. You never hear of the other 605 drugs—not that anyone wants to cover anything up—it's just a waste of time to talk about things of no value. In a scientific journal all 606 formulas might be given, but in a semi-popular account the story would certainly be slanted toward the one attempt that was a success.

We sometimes report that no cycle of such and such a length was found in such and such a series of figures, but not often. The reason is partly the uselessness of reporting—for the general public—the things of no value, and partly because we rarely study a cycle unless it is clearly evident to start with. If a cycle is so obscure that it can't be seen by inspection, its significance is pretty doubtful anyway.

You ask, "What about cycles that fail after a number of years?" The simple answer to this is that if they fail they need no longer be considered as valid cycles, but this is not the right answer for there are cycles that are positively valid cycles and which still fade out or fail. I have traced cycles for hundreds of years which have faded out. I think we must face the fact that real cycles do behave this way and apply ourselves to knowing why, and why they fade out. Eclipses of the moon occurred in a certain pattern for hundreds of years and then the cycle faded out. At the time no one knew why, but of course eventually they learned.

You also ask about the possibility that if I present the material another way there won't be a cycle at all. This also is correct. For instance suppose you have a marked seasonal or 12-month cycle, as in the ice cream business. If you take a 12-month moving average of these figures you can remove this cycle completely. You can also remove it by taking the percentage that the sales for each month are of the month twelve months before.

All we can claim for ourselves is honest intent and reasonable competence. We never jimmy the figures or force them to tell a story other than the truth, as we see it. *E. R. D.*

THE STOCK MARKET

Dear Mr. Dewey:

The 1831-1958 chart of stock prices and trend is especially appreciated. It covers the longest span of years of any such chart I have seen and gives a perspective not to be had in shorter term charting.

Could the data be made available from 1831 and preferably on a monthly rather than an annual basis?

Also, in a prior series you have shown that typically a growth curve takes on the appearance of a flattened "S" and if a series is carried far enough will eventually become bell-shaped, lacking some new impetus to change it. Why, then, over a span of 127 years in stock prices is the growth trend a straight line? Wouldn't it be more in keeping with other experiences to have expected a curved line?

Reading, Mass. Arthur J. Dolben

Comment: It is true that typically a growth curve is a bent rather than a straight line. But if you look at the line of the data on that chart, perhaps you will agree with us that an "S" curve just wouldn't fit as well as the straight line does.

It is strictly a matter of opinion. One can go through an elaborate routine, numerically speaking, to decide what kind of a trend to use. But this does not mean that one's results are any more reliable than if one uses a very simple process.

Consider just the line of data on the chart. Squint your eyes and hold the paper at arm's length. Then ask yourself, "How does that line flow?" We think it goes straight up-hill.

Now if you decide the trend line should be curved, draw in a curved line, and use that one in thinking about the trend of the stock market. There is nothing sacred about our line.

One point, however, This series is a dollar series. If memory serves me, all the trends we have used which were curved have been of physical series--tons, or barrels, or yards, etc. This may account for the difference.

The annual figures for the stock price series, 1831-1958 are given below. The monthly figures for the 1871-1956 period were published in the October 1958 issue of *Cycles*. *E. R. D.*

Standard & Poor's Combined Index, and Earlier Indexes
1941-43=10

Year	Index	Year	Index	Year	Index	Year	Index	Year	Index	Year	Index
1831	2.11	1853	3.21	1875	4.45	1897	4.45	1919	8.78	1941	9.82
1832	2.18	1854	2.64	1876	4.06	1898	5.05	1920	7.98	1942	8.67
1833	2.85	1855	2.38	1877	3.14	1899	6.29	1921	6.86	1943	11.50
1834	2.61	1856	2.43	1878	3.38	1900	6.15	1922	8.41	1944	12.47
1835	3.51	1857	2.12	1879	4.12	1901	7.84	1923	8.57	1945	15.16
1836	3.03	1858	1.73	1880	5.21	1902	8.42	1924	9.05	1946	17.08
1837	2.27	1859	1.50	1881	6.25	1903	7.21	1925	11.15	1947	15.17
1838	2.01	1860	1.85	1882	5.90	1904	7.05	1926	12.59	1948	15.53
1839	1.84	1861	1.93	1883	5.63	1905	8.99	1927	15.34	1949	15.23
1840	1.59	1862	2.56	1884	4.74	1906	9.64	1928	19.95	1950	18.40
1841	1.48	1863	3.96	1885	4.60	1907	7.84	1929	26.02	1951	22.34
1842	1.09	1864	4.21	1886	5.36	1908	7.78	1930	21.03	1952	24.50
1843	1.36	1865	3.96	1887	5.53	1909	9.71	1931	13.66	1953	24.73
1844	2.17	1866	4.21	1888	5.20	1910	9.35	1932	6.93	1954	29.69
1845	2.11	1867	4.21	1889	5.32	1911	9.24	1933	8.96	1955	40.49
1846	2.23	1868	4.77	1890	5.27	1912	9.53	1934	9.84	1956	46.62
1847	2.41	1869	4.88	1891	5.03	1913	8.51	1935	10.60	1957	44.38
1848	2.18	1870	4.36	1892	5.55	1914	8.08	1936	15.47	1958	46.24
1849	2.29	1871	4.69	1893	4.78	1915	8.31	1937	15.41		
1850	2.53	1872	5.03	1894	4.39	1916	9.47	1938	11.49		
1851	2.80	1873	4.80	1895	4.53	1917	8.50	1939	12.06		
1852	3.15	1874	4.57	1896	4.23	1918	7.54	1940	11.02		

Cleveland Trust Index of Railroad Stock Prices, 1831-1853
Clement-Burgess Index of Common Stock Prices, (mostly railroads) 1854-1870
Standard & Poor's Index of Combined Stock Prices, 1871-1958

Foundation Affairs

J. H. DOUGLAS WEBSTER ELECTED TO COMMITTEE

We are pleased to announce that our Board of Directors has elected Dr. J. H. Douglas Webster of London, England, to membership on the Committee of the Foundation.

Dr. Webster, who was born in Edinburgh in 1882, was educated at the University of Edinburgh and at Prague. He spent many years as a Radiotherapist and Radiologist and was a consulting Radiotherapist at Middlesex Hospital as well as Lecturer and Examiner on Radiology at the University of London. He served with the Royal Army as a radiologist, and was later President, Section on Radiology, B.M.A.

More recently Dr. Webster has been engaged in research on the periodicity of events in life, in creativeness, nature and art, and in disease.

He has published many works on periodicity. Among them, *The Periodicity and Cause of Cancer*, is one of his contributions to the knowledge of rhythmic fluctuations in the field of medicine. Dr. Webster's work on periodicity in other fields has also gained attention; in the March 1958 issue of *Cycles* we reprinted his paper "Periodic Inspiration in Poetry and Music."

We are indeed happy to have Dr. Webster on the Committee.

Dr. J. H. Douglas Webster

Chapter Affairs

NEW YORK JULY MEETING

The nineteenth regular monthly dinner-meeting was held on Thursday, July 16. The speaker was Dr. Forrest P. Speicher, Chief Biologist of Philco Corporation. He spoke on "Natural and Artificial Ionization of the Air."

Dr. Speicher explained that all outside air contains charged particles called ions. Both positive and negative ions are present, but there is usually a slightly larger number of negative ions present. When there is a preponderance of negative ions in the air, a feeling of mental exhilaration often occurs. Conversely, when there is a preponderance of positive ions, mental depression may result. Adding a preponderance of negative ions is reputed by some to be a cure for such ailments as high blood pressure, hay fever, asthma, ozena, mental irritability, and the pain of burns.

The speaker reported that there is a daily, or 24-hour cycle in the ion level of the atmosphere. The peak of the cycle is shortly after sunrise, and the low shortly after sunset. So far as has been determined, there is no seasonal variation.

Some of our leading electronic equipment manufacturers have been working on, and may soon market a machine to produce negative ions and add them in appropriate concentrations to the air. These devices will be for use in schools, homes, hospitals, offices, etc.

Dr. Speicher pointed out that, "It is the imbalance of ions in favor of the negative ions which produces exhilaration, and the imbalance in favor of positive ions which produces depression. . .

"The 'missing factor' in air conditioning is the lack of negative ions in the air. Although air conditioners produce the proper temperature and humidity, and reduce pollen count by filtering the air, they nevertheless fail to reproduce the bracing properties of pure fresh air. . .

"A sharp increase in the ion level may mean a thunderstorm is soon to follow. . .

"Negative ionization increases work capacity; positive ionization decreases it. . ."

An extended question-and-answer period followed the talk. Cooperating with Dr. Speicher in handling some of the questions were Lloyd A. Staebler, Philco Corporation, Dr. Rudolph Nagy, Advisory Engineer of Westinghouse Electric Corporation, and Dr. Sherwin A. Kaufman, Medical Director of Planned Parenthood of Manhattan and Bronx.

Jack A. Dorland

The Cycle Round-up

SEPTEMBER 1959

For those of you who are following any of the series we review from time to time in this section, the recent figures are reported below.

LATE FIGURES

Series	Unit	Month	Amount
Aluminum Production	Thousand tons	May	164
Automobile Factory Sales	Thousand cars	May June	545r 558p
Copper Prices—Electrolytic, New York	Cents per pound	June	31.10
Egg Prices—Wholesale, large, Chicago (delivered)	Cents per dozen	June	27.5
Liabilities of Business Failures	Million dollars	June	49.2
Residential Building Contracts—F. W. Dodge	Million dollars	May	1,677
Stock Prices— -Standard & Poor's Combined Index	1941-43=10	June	57.46
Sunspot Numbers	Numbers	June	167
Unemployment	Per cent	June	5.58

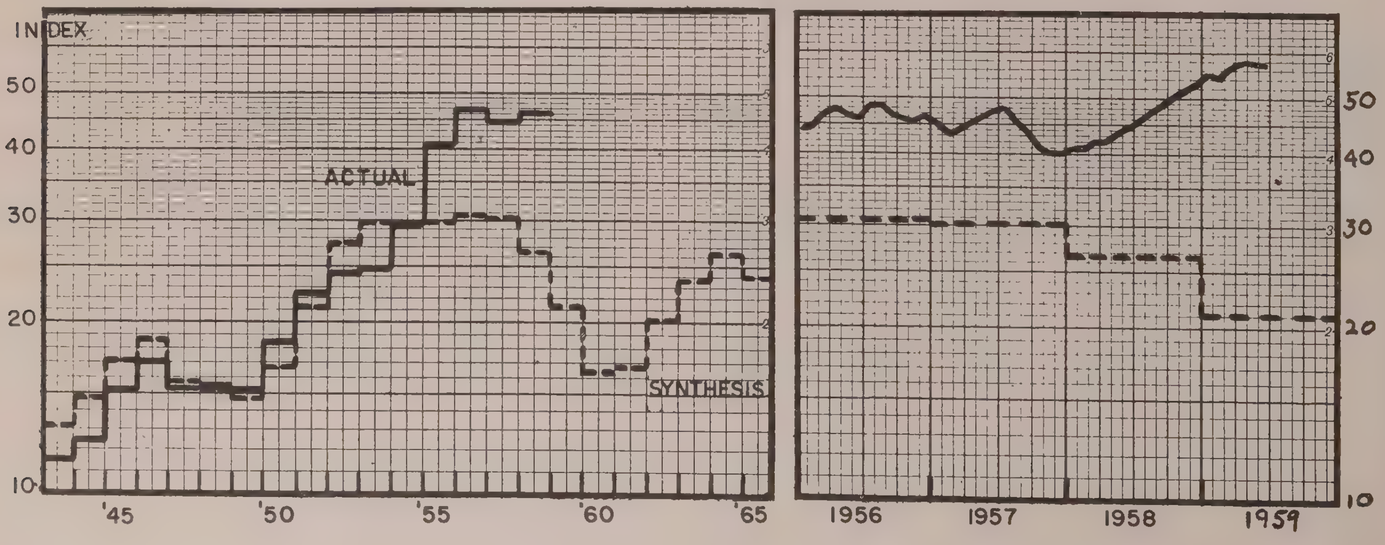
p - preliminary; r - revised

STOCK PRICES

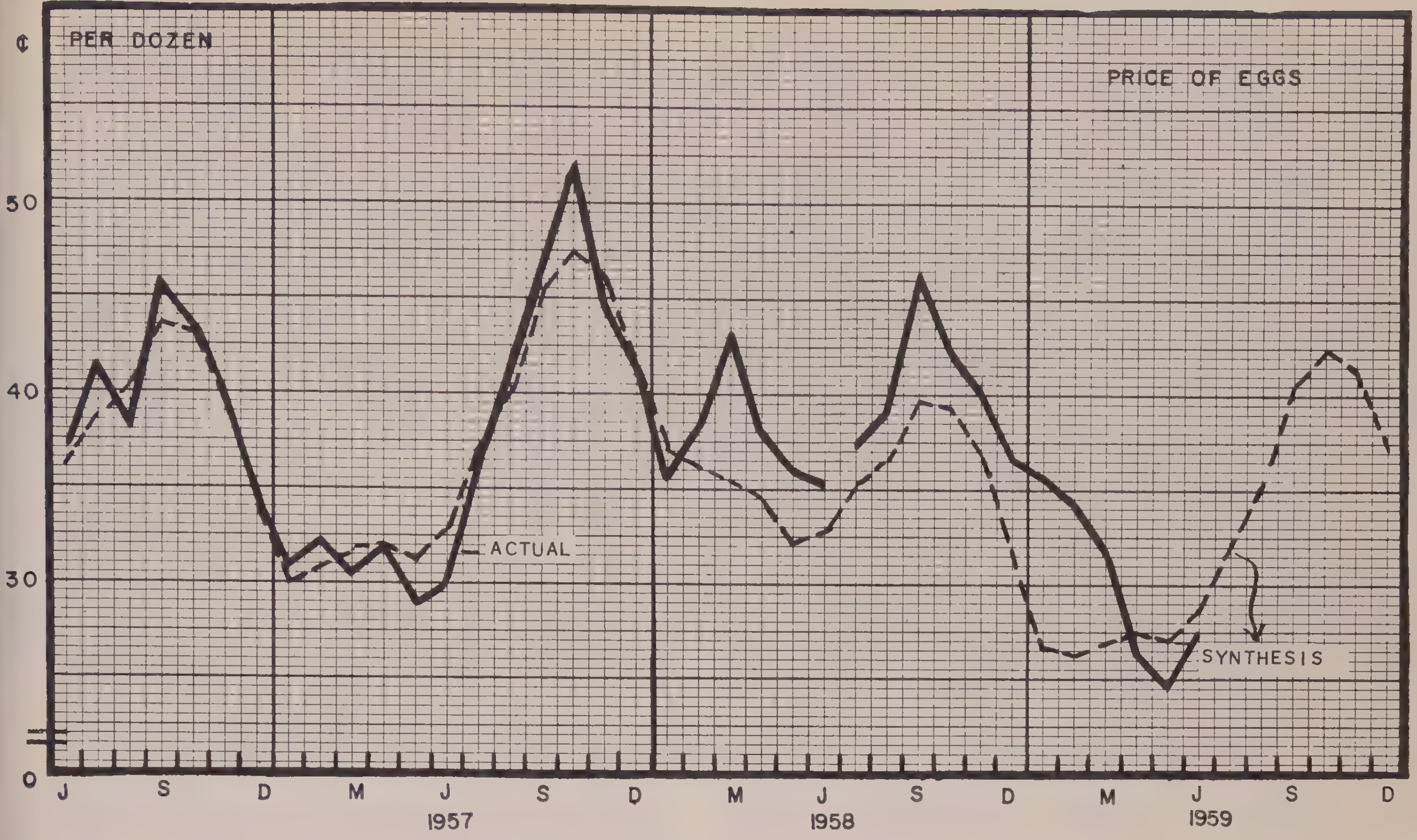
The synthesis line on the chart below is a combination of the 11 cycles isolated in this series plus the underlying trend.

The recent actual figure (Standard & Poor's Combined Index, 500 stocks) is given in the table above.

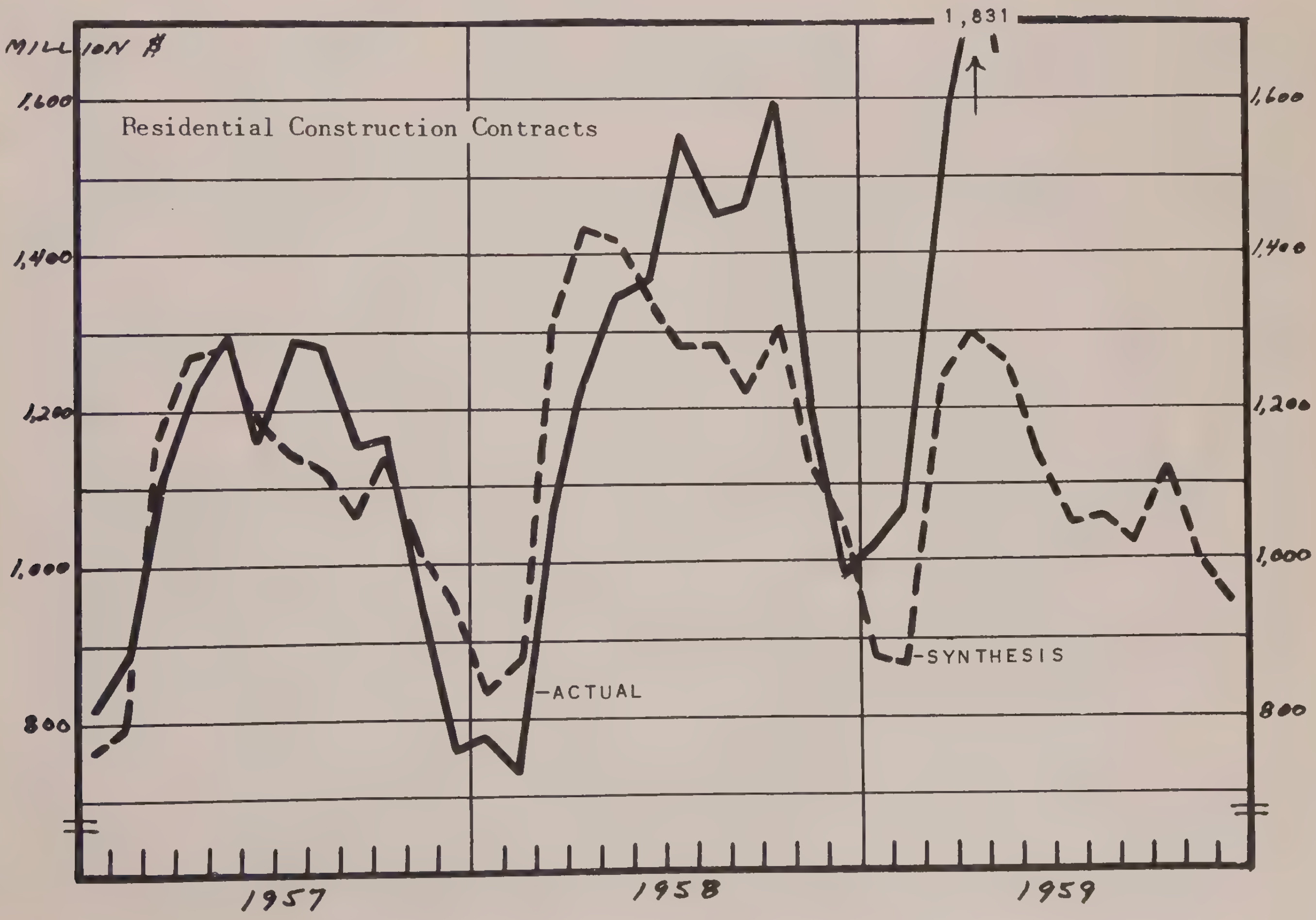
Current figures of this series are carried in daily newspapers.



EGG PRICES



RESIDENTIAL BUILDING

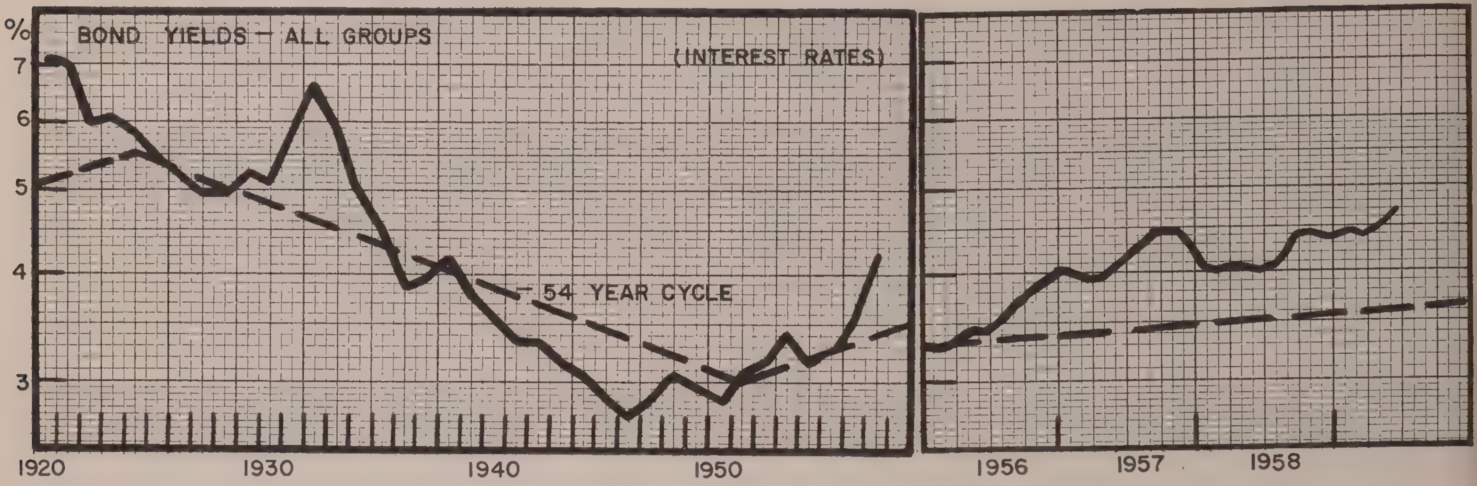


BOND YIELDS

The broken line on the chart represents the ideal 54-year cycle in bond yields. This cycle will continue upward until about 1978.

The actual figures plotted as a solid line are for all domestic corporations, as published by Moody's. Recent monthly figures are:

May - 4.60%
June - 4.69

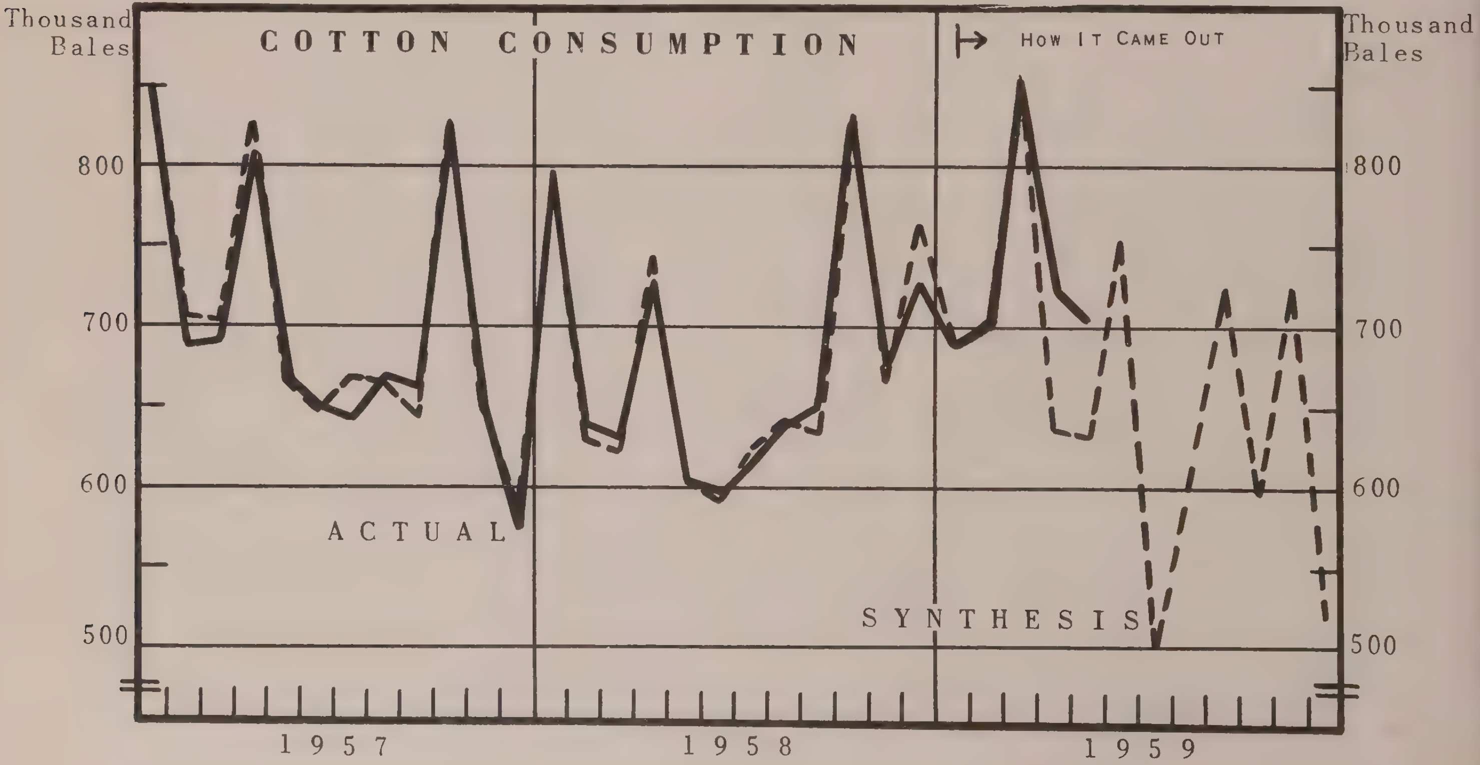


COTTON CONSUMPTION

The broken line on the chart is a combination of the 12-month and the 23.75-month cycles in cotton consumption, together with the underlying trend.

The solid line diagrams the actual monthly amount of cotton consumption since 1957. Recent monthly values are:

Apr - 717 thousand bales
May - 702

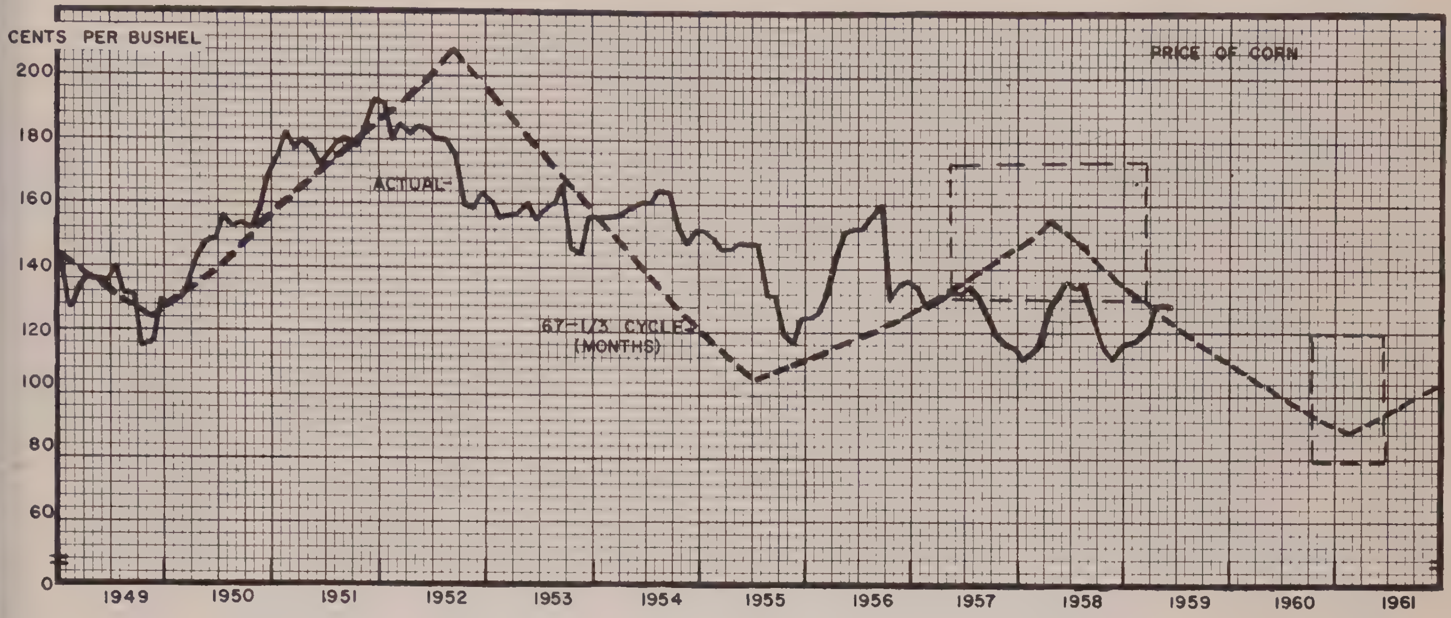


CORN PRICES

The ideal 67 1/3 month cycle is currently going down toward a low due at February, 1961.

The odds are 2 to 1 that the actual price will reach a low within the time limits of the box on the chart, and 6 to 4 that the low will be within the levels set by the box.

During June, the average price of No. 3 yellow corn at Chicago was 128.9 cents a bushel.



MANUFACTURING PRODUCTION

The idea behind this chart was that short cycles, including any dynamic cycle, would operate around the basic structure of the series. The basic structure includes the 36- and 50-year cycles and the underlying trend.

The Manufacturing Production Index for June was 159.

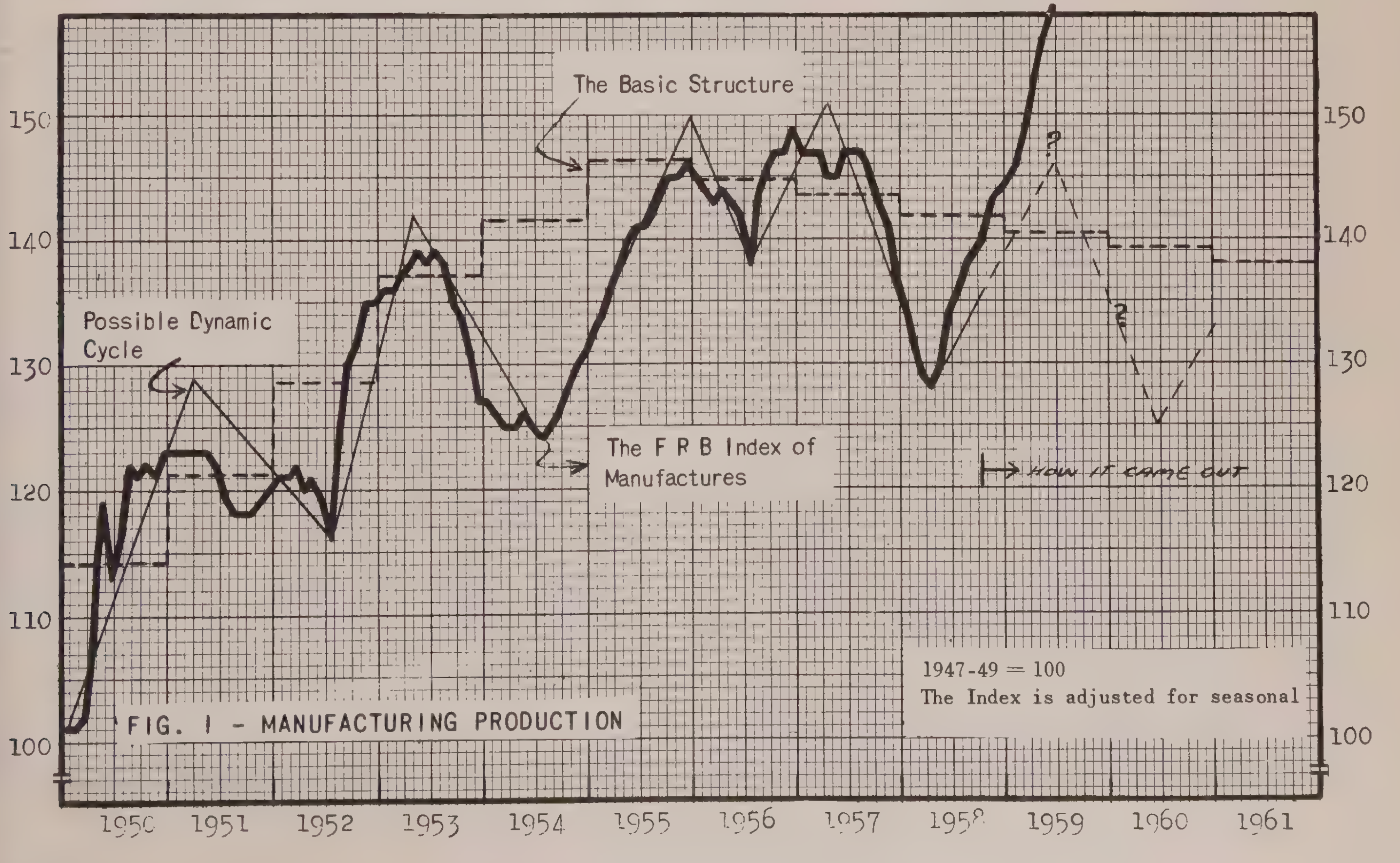
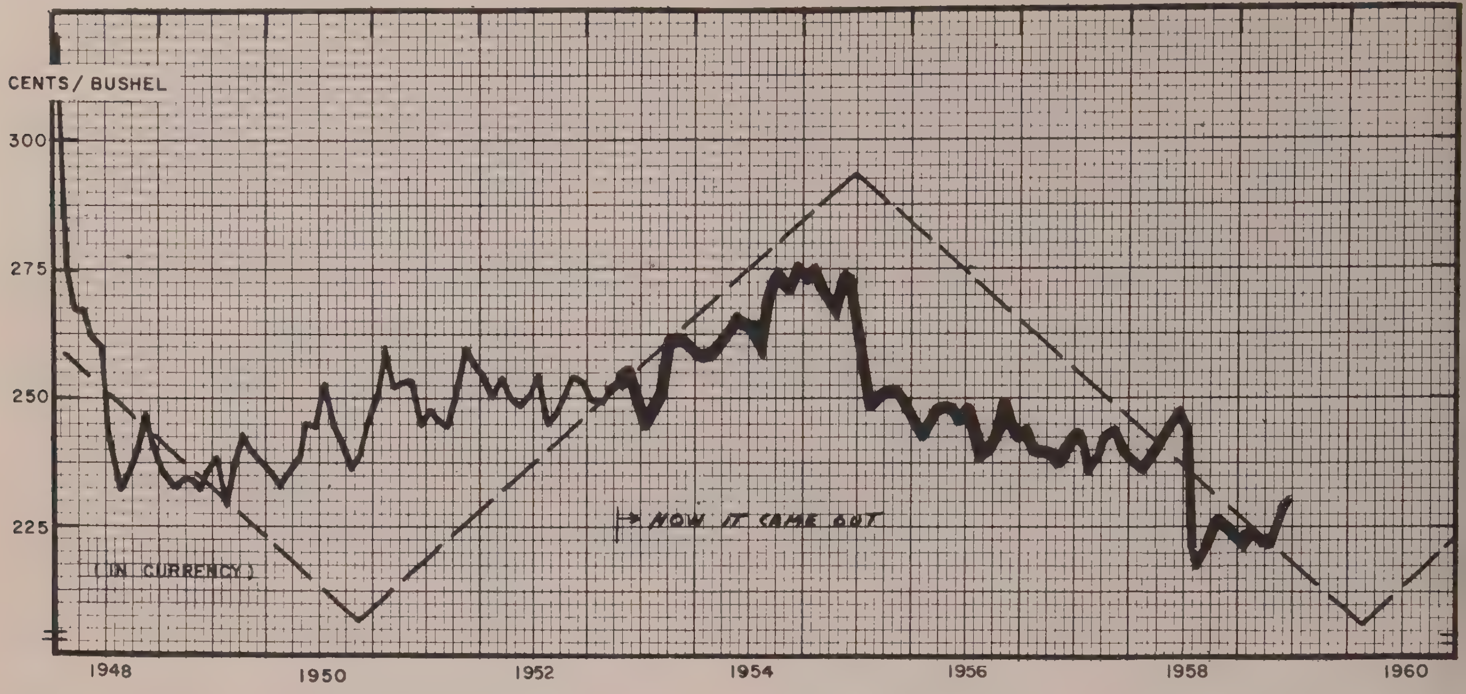


FIG. I - MANUFACTURING PRODUCTION

1947-49 = 100
The Index is adjusted for seasonal

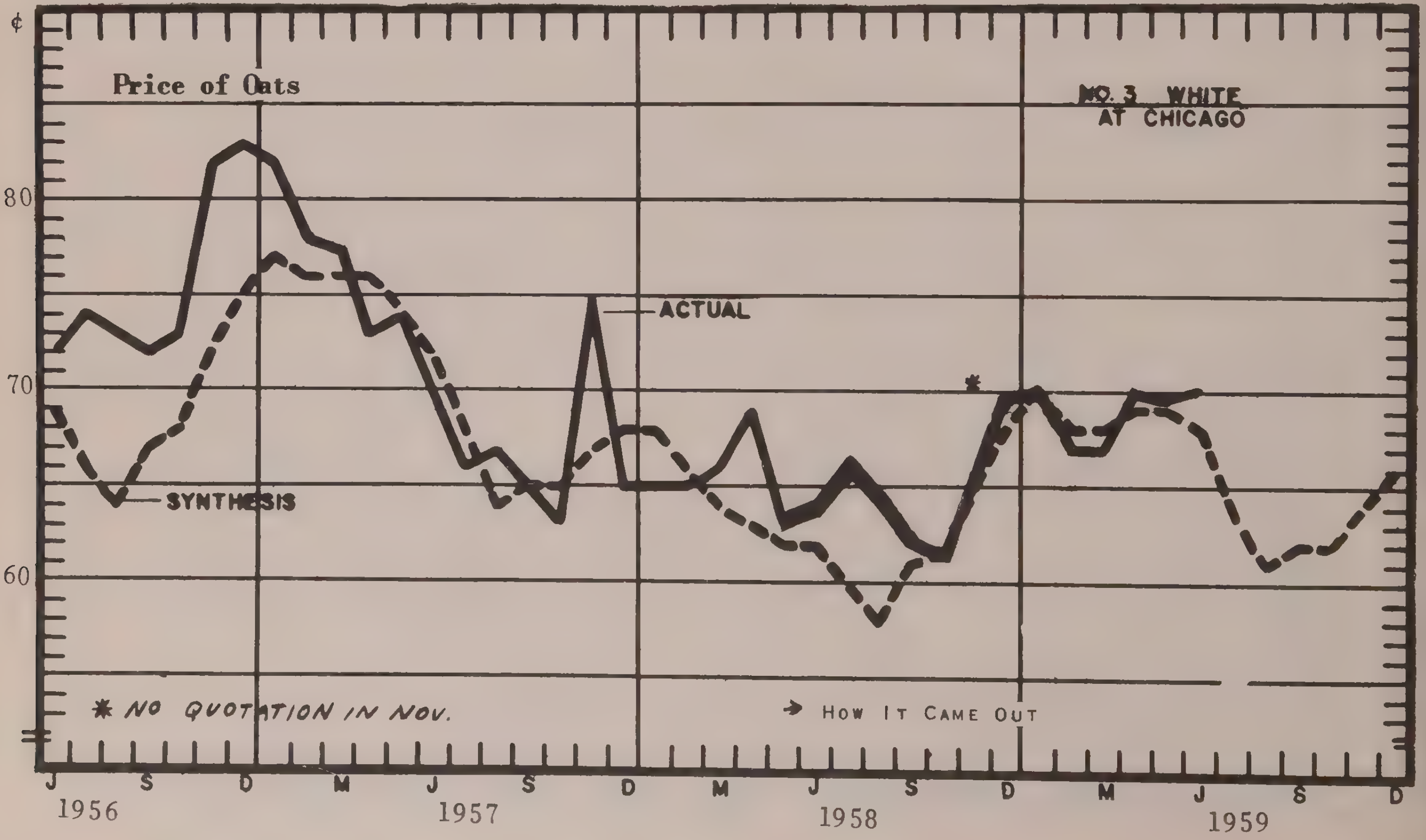
WHEAT PRICES

The price of wheat at Minneapolis during June was 231.0 cents per bushel. The broken line on the chart below is the ideal 9.3-year cycle in wheat prices.



OATS PRICES

The synthesis line on the chart includes the 26.64- and the 12-month cycles together with the underlying trend. During June the price of No. 3 white oats at Chicago was 70 cents.



The Geisinger Indicator

FORECAST

The Index of Production and all the Indicators went up during the last month prior to the steel strike. The Indicators cannot directly assess the effect of the strike—however, it may be possible to get a rough idea of the effect of the strike by other means.

First, however, we should review the Indicators and the Index of Production. In June, production again reached a new peak, with the seasonally adjusted Federal Reserve Board Index at 155. (The Federal Reserve Board revised the May Index to 153.)

The Geisinger Indicator for March (November when advanced) was up to 4.2.

The First Difference Indicator was up to 2.67 in May.

The Modified Geisinger Indicator moved up to 6.20 in March (November when advanced).

Except for the steel strike the outlook continues to be good.

The production of ferrous metals in the base period (1947-49) of the F. R. B. Index took 6.70 points out of the 100 base. This proportion went to *primary* production of steel, pig iron, etc. At the June 1959 Index level of 155, this amounts to about 10 points. In July, therefore, about 5 points (half a month) will be lost.

Metal fabricating (which uses both ferrous and non-ferrous metals) took over 28 points in the 1947-49 base Index of 100. If and when the effect of the strike filters through fabricating industries the Index will decline even more.

Another way of gauging the effect of the steel strike is to study 1956. At that time a steel strike (June 30 to August 5) caused a drop in the Index of Industrial Production which amounted to 4% for the month of July. In August 1956, however, the Index of Production bounced back to its previous high levels. We can expect a strike of similar duration (36 days) to have about the same effect.

July 29, 1959 *E. R. Dewey*

Month	F.R.B. Index	Geisinger Indicator	First Difference Indicator	Modified Geisinger Indicator	Timing Advanced 8 Months
Jan-1959	143	2.2	1.50	3.70	1959-Sep
Feb	145	3.2	1.50	4.70	Oct
Mar	147	4.2	2.00	6.20	Nov
Apr	150	*	2.50r	*	Dec
May	153r	*	2.67p	*	1960-Jan
Jun	155p	*	*	*	Feb

p - preliminary r - revised * - not yet available

BACKGROUND

The Modified Geisinger Indicator is a series of numbers which, in the past, have gone up and down ahead of corresponding movements of the Federal Reserve Board Index of Industrial Production. The Modified Geisinger Indicator thus throws some light on the probabilities of the future.

The F. R. B. Index of Industrial Production measures physical production in the U. S. A. It is a weighted average of tons, yards; gallons, and numbers of things produced each month.

The Modified Geisinger Indicator is the sum of two Indicators, the Geisinger Indicator and a First Difference Indicator.

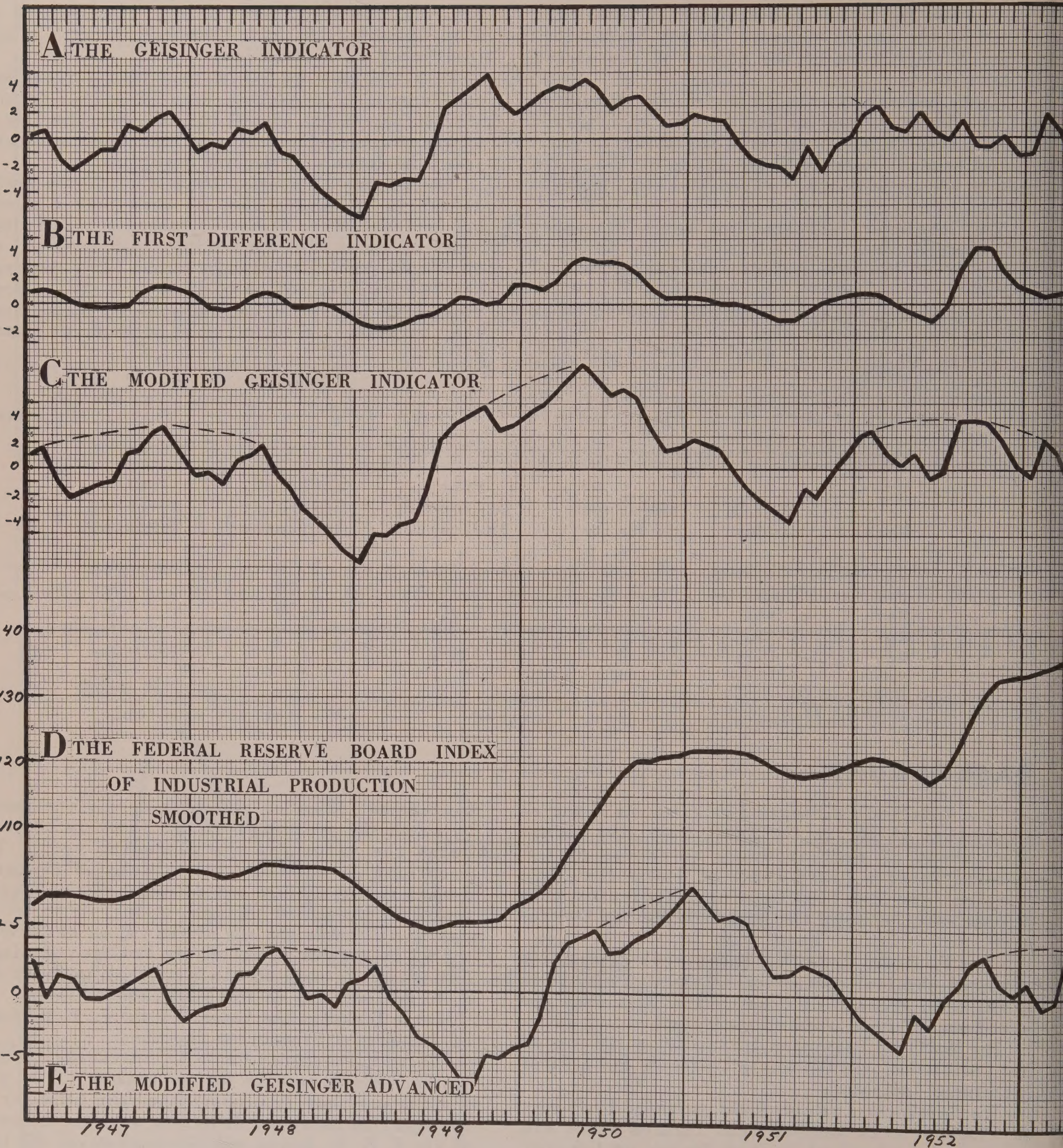
The Geisinger Indicator was invented by Robert Geisinger. It is derived from figures which are published each month in the *Survey of Current Business*. It is charted for you as Curve A on pages 142 and 143.

Curve B on these same two pages charts the First Difference Indicator, which is merely the amount by which the smoothed F. R. B. Index is above or below the value for the preceding month. The smoothing is effected by means of a centered 3-month moving average and a 2-month moving average posted to the second position.

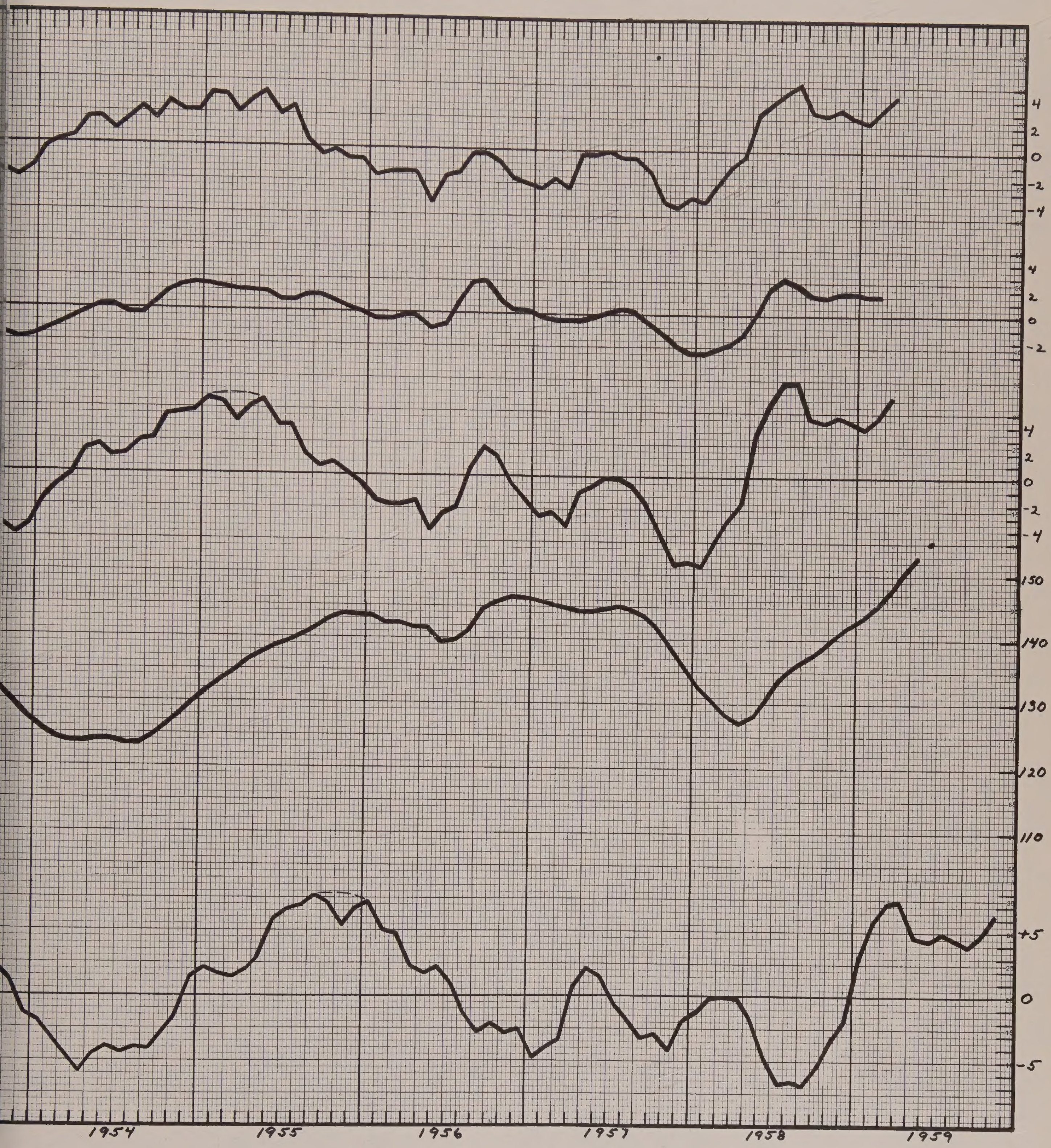
Curve C charts the sum of the values of Curves A and B. This curve is called the Modified Geisinger Indicator. It suggests in a general way what the F. R. B. Index may do some eight months later.

Curve D charts the values of the F. R. B. Index of Industrial Production smoothed.

Curve E re-charts Curve C, advancing it by 8 months. This advance is for two reasons (1) so that you can more easily compare the past behavior of the Modified Geisinger Indicator with the behavior of the F. R. B. Index, and (2) so that you can have a better idea of what the F. R. B. Index may do in the future.


A THE GEISINGER INDICATOR
4
2
0
-2
-4
B THE FIRST DIFFERENCE INDICATOR
4
2
0
-2
C THE MODIFIED GEISINGER INDICATOR
4
2
0
-2
-4
140
130
D THE FEDERAL RESERVE BOARD INDEX OF INDUSTRIAL PRODUCTION SMOOTHED
120
110
+5
0
-5
E THE MODIFIED GEISINGER ADVANCED
1947
1948
1949
1950
1951
1952

OF INDUSTRIAL PRODUCTION



Turn to page 213 for the Forecast.

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